Claims:

WHAT IS CLAIMED IS:

1. A microscope, comprising:

a stage for holding a sample;

an illumination source;

means for dynamically selecting the spectral components of the illuminating beam;

an objective receiving light from the sample and providing an image beam;

means for dynamically filtering the image beam to thereby select spectral components of the image beam;

means for converting the image beam to an electrical signal;

a computer-based controller for providing a plurality of image planes, each image being composed by selection spectral components for the illuminating beam and the image beam that differ from the other image planes, wherein the image planes are represented by said electrical signal and the controller selectively maps one or a combination of said image planes to one of a plurality of color planes and combines said color planes to provide a color image for display to a user.

2. A microscope according to claim 1, including means for dynamically selecting an optical path for illuminating the sample with a beam of light from the illumination source, thereby determining an illumination mode, wherein said controller dynamically controls the illumination mode for each said mage plane.

3. A microscope according to claim 2, including an image intensifier disposed to receive said image beam and provide a light image to said electrical signal conversion means, said image intensifier having a

controllable photon gain which is dynamically selected by said controller for each said image plane.

4. A microscope according to claim 1, wherein said color planes are spectrally distinct.

5. A microscope according to claim 1, wherein said mapping includes inverting the polarity of said image beam.

6. A microscope according to claim 1, wherein said mapping includes performing arithmetic operations on said image planes.

7. A microscope according to claim 3, including means for gating said image intensifier or placing a controllable shutter in the path of said illumination beam.

8. A microscope according to claim 3, including means for splitting said image beam into multiple image beams, wherein multiple image intensifiers, each sensitive to different incident light, produce multiple polychromatic images received by multiple cameras, said controller combining the electrical signals provided by said multiple cameras to obtain a single color plane.

9. A microscope according to claim 3, including means for splitting said image beam into multiple image beams, wherein multiple image intensifiers, each sensitive to different incident light, produce multiple polychromatic images received by multiple cameras, wherein said controller obtains an image from each camera to generate a separate color plane

10. A microscope according to claim 1, wherein said illumination source combines light from a plurality of light sources to produce said illuminating light beam having spectral content in the range of about 200 nm to 2200 nm.

11. A microscope according to claim 1, including means for polarizing said illuminating beam.

12. A microscope according to claim 1, including means for polarizing said image beam.

13. A microscope according to claim 1, including means for coupling a laser beam into said illuminating beam.

14. A microscope according to claim 13, wherein said coupling means includes a moveable mirror or prism controllable by said controller.

15. A microscope according to claim 13, including a selectively actuatable filter for eliminating said laser light from said illuminating beam.

16. A microscope according to claim 3, wherein said illumination mode selection means includes a moveable mirror or prism controllable by said controller.

17. A microscope according to claim 3, wherein said illumination mode selection means includes a computer controlled monochromator

18. A microscope according to claim 1, wherein said spectral component selection means includes a cycling set of illumination filters.

19. A microscope according to claim 3, wherein said illumination modes include at least two modes selected from the group: transmitted brightfield, transmitted darkfield reflected brightfield, reflected darkfield, phase contrast, and slit ultramicroscopic.

20. A microscope according to claim 3, including a beam steering mirror controlled by said controller for directing said illuminating beam on a

transmitted light illumination path in which light travels at least through a condenser or a reflected light illumination path in which said illuminating light bypasses the condenser.

21. A microscope according to claim 1, including an aperture and scanning system added in the path of said illuminating beam for scanning said illuminating beam over an area of said sample.

22. A microscope, comprising:

a stage for holding a sample;

an illumination source;

means for dynamically selecting an optical path for illuminating said sample with a beam of light from said illumination source, thereby determining an illumination mode;

means for dynamically selecting the spectral components of the illuminating beam;

an objective for receiving light from the sample and providing an image beam;

means for dynamically filtering the image beam to thus select components of the image beam;

an image intensifier for converting said image beam to a polychromatic image, the image intensifier having a controllable photon gain;

a monochrome camera for converting the output of the image intensifier to an electrical signal;

a computer-based controller for providing a plurality of image planes, each of which is composed through selective control of the illumination mode, the photon gain and the spectral components of the illuminating beam and the image beam, wherein the image planes are represented by said electrical signal and the controller selectively maps one or a combination of said image planes to one of a plurality of color planes combines said color planes to provides a color image for display to a user.

23. A microscope, comprising:

a stage for holding a sample;

an illumination source;

means for selecting an optical path for illuminating said sample with a beam of light, thereby determining an illumination mode;

means for cyclically selecting the spectral components of the illuminating beam from a predetermined set of illuminating wavelengths;

an objective for receiving light from the sample and providing an image beam;

means for cyclically filtering the image beam from a predetermined set of filters to thereby cyclically select spectral components of the image beam;

means for converting the image beam to an electrical signal;

a computer-based controller for providing a plurality of image planes, each image plane occurring once per cycle and composed of a pre-selected configuration of the illumination mode and the spectral components of the illuminating beam and the image beam, wherein the image planes are represented by said electrical signal and the controller maps one or a combination of said image planes to one of a plurality of color planes according to a pre-selected configuration and combines said color planes to provide a color image per cycle for display to a user.

24. A method of obtaining an image of a sample using a microscope having an illumination source, a stage for holding a sample, and an objective for receiving light from the sample and providing an image beam, the method comprising:

selecting the spectral components of the illuminating beam;

filtering the image beam to thereby select spectral components of the image beam;

generating a plurality of image planes, each image plane being composed by selecting spectral components for the illuminating beam and the image beam that differ from other image planes; and

mapping one or a combination of said image planes to one of a plurality of color planes; and

combining the color planes to provide a color image for display to a user.

25. A method according to claim 24, including converting the image beam to an electrical signal and electronically implementing said image plane mapping and color planes combining so as to provide said color image on a display monitor.

26. A method according to claim 24, amplifying said image beam according to a photon gain selected for each image plane prior to converting said image beam to said electrical signal.

27. A method according to claim 26, including selecting an illumination mode for illuminating the sample in each image plane.

28. A method according to claim 24, wherein said color planes are spectrally distinct.

29. A method according to claim 24, wherein said mapping includes inverting the polarity of said image beam.

30. A method according to claim 24, wherein said mapping includes performing arithmetic operations on said image planes.

31. A method according to claim 26, including shuttering said image beam or said illumination beam.

32. A method according to claim 24, wherein said illumination beam has a spectral content in the range of about 200 nm to 2200 nm.

33. A method according to claim 24, including polarizing said illumination beam or said image beam.

34. A method according to claim 24, including coupling a laser beam into said illumination beam.

35. A method according to claim 27, wherein said illumination modes include at least two modes selected from the group: transmitted brightfield, transmitted darkfield reflected brightfield, reflected darkfield, phase contrast, and slit ultramicroscopic.

36. A method according to claim 24, including scanning said illuminating beam over an area of said sample in order to obtain an image for said image plane.

37. A method of obtaining an image of a sample using a microscope having an illumination source, a stage for holding a sample and an objective for receiving light from the sample and providing an image beam, the method comprising:

cyclically selecting the spectral components of the illuminating beam using a predetermined set of illuminating wavelengths;

cyclically filtering the image beam using a predetermined set of filters to thereby cyclically select spectral components of the image beam;

generating a plurality of images plane per cycle, each image plane being based on a selection of spectral components for the illuminating beam and the image beam that differ from the other image planes in the cycle; and

once per cycle mapping one or a combination of said image planes to one of a plurality of color planes according to a pre-selected configuration and combining said color planes to provides a color image for display to a user.

38. A method according to claim 37, including cyclically selecting an optical path for said illuminating beam so as to illuminate said sample in various modes according to a pre-configured pattern.

39. A method according to claim 37, including converting the image beam to an electrical signal and electronically implementing said image plane mapping and color planes combining so as to provide said color image on a display monitor.

40. A method according to claim 39, including cyclically amplifying said image beam for each image plane according to a predetermined set of photon gains, prior to converting said image beam to said electrical signal.